

## 言語と思考の起源論

### Theories on the Origin of Language and Thought

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#### 要旨

多くの言語学者の一般的な定説によれば、もし原始時代の人類にどのように言語が発生したかを理解することができれば、全ての子どもの自然な言語能力の習得方法を理解することができると考えられている。本論では、表題が示すように言語と思考に関する起源についての先行研究を再考察したものであり、この2つの重要な心的機能の共生依存を検証するものである。

#### Abstract

It is generally accepted among linguists that, to further elucidate how language effortlessly emerges in each newborn, a greater understanding of how language originated in primordial human beings is required. This paper, as the title suggests, is a review of contemporary theories on the origins of language and thought, and surveys the symbiotic dependency between these two important mental faculties. Moreover, this paper will attempt to further draw attention to the relation between primordial and present day language acquisition. The premise of this paper is that bad theories are not defeated by criticism; bad theories are replaced by better theories. This paper should, therefore, be viewed as a survey of what is plausible rather than a critique of what is not. The topics covered in this paper include Darwinian evolution, Lamarckian mechanisms, punctuated equilibrium and recursion.

● Keywords : Universal Grammar, Poverty of Stimulus, I-language / E-language

“Without language, thought is a vague uncharted nebula.”

– Saussure

#### Introduction

The evolutionary account for life on earth, since at least the advent of Darwinian principles, has gained universal acceptance in all but the sketchiest corners of scientific understanding. It is now widely taken for granted that all life as we know it is a product of gradual natural selection. The same cannot be said for our account of language, and indeed the human faculty of rational thought. There is of course observably stark contrast between human and nonhuman systems of communication. The evolutionary basis for nonhuman communication, animal cries, grunts, and purposeful

body movements is for the most part not in dispute. However, the origin of human language, not only as a form of communication, but also with its implications in directing the development of human thought, seems by some accounts to pose a serious challenge to standard evolutionary models. Perhaps, what is hardest to grasp about human language, in its multifarious modes of performance, is that it appears so disproportionate to all nonhuman forms of communication. In fact, the dichotomy seems so poignant it almost appears as if human language emerged by unnatural means. Seemingly, if not uneasily, this can be seen as analogous to pre-Darwinian accounts that once claimed special or divine creation of the entire human species, separate and distinct from the rest of nature. As a sidebar to this point, it should be noted that Darwin, in his submission

of common descent, never ventured to refute dogmatic claims of a divine creation. He simply proffered a more plausible and tenable hypothesis. As it turned out, his natural explanations were capable of accounting for a common origin indicative of all species, without any appeal to the supernatural.

In much the same vein, as notions of special creation were supplanted by Darwin's natural explanations, edicts of special evolution now cast some degree of doubt on Darwinian accounts of language. Numerous linguists have called into question the role that natural selection, the slow steady continuous evolution of life, may have played in the emergence of language. For the most part, such suspicions arise out of the immense gap between the functionality of language and nonhuman communication. From its controversial publication to its common acceptance *The Origin of the Species* would seem to have enjoyed little resistance, at least in scientific quarters. The Darwinian account, that all life is subject to slow steady evolution by means of natural selection, has not only served to describe the peculiar traits found within the species, but it has been pressed to explain numerous phenomena from erosion to economics.

Mapped onto natural selection, language would appear to be no exception. By Darwinian accounts, as an adaptation from animal cries, the notion that purposeful human speech was derived from small continuous changes over time seems a likely path to language. As a consequence of enhanced social functions, retained and replicated over time, language could plausibly have resulted from the use of ever increasingly complex utterances. It is no stretch of the imagination to conceive, as Darwin hypothesized, that early language developed like any other biological adaptation, in accordance with standard evolutionary models.

The formation of different languages and of distinct species, and the proofs that both have been developed through a gradual process, are curiously the same. But we can trace the origin of many words further back than

in the case of species, for we can perceive that they have arisen from the imitation of various sounds, as in alliterative poetry.

(Darwin, 1871, p59)

At some point, in the earliest stages of the evolution of language, something very dramatic must have happened. The human 'imitation of sounds' developed into distinct words, and the sequencing of these words became subject to syntactic regulation. By all accounts this was a very curious occurrence, in which the hereditary passing of traits from one generation to the next seems to have swerved away from the unremitting control of Darwinian natural selection. That is to say, intrinsic to the use of language is the capacity to consciously circumvent the natural order. In classical Darwinian fashion, biological traits sequenced in DNA are transferred from paired progenitors to singular offspring through genetic reproduction. As such, the biological capacity to produce sounds and utterances can be regulated as a basic unit of natural selection. However, with the emergence of words, and the ability of successive generations of offspring to use and retain words, the social capacity for the transfer of traits began to manifest at an unparalleled level. Moreover, through the use of words, it became possible for information generated by particular individuals to be directly spread and retained over an entire linguistic community.

Why can't organisms figure out what would do them good, develop those adaptive features by dint of effort during their lifetimes, and then pass those improvements to their offspring in the form of altered heredity? We call such a putative mechanism 'Lamarckism' [...] Natural evolution would go like gangbusters if heredity happened to work in this manner. But, unfortunately, it doesn't [...] But cultural change, on the radical other hand, is potentially Lamarckian in basic mechanism. Any cultural knowledge acquired in one generation can be directly passed to the next.

Gould, 1996, p. 221

As opposed to Darwinian principles of genetic mutations, developed in the course of reproduction,

Lamarckian mechanisms involve the transfer of physiological variations that are acquired as a result of actions directly incurred by organisms. The 18<sup>th</sup> century French naturalist Jean-Baptiste Lamarck believed that changes in an organism during the course of its life could be passed down directly to its offspring. He infamously applied this type of inheritance to giraffes, which he believed had acquired their long necks because successive generations had stretched further and further to reach their food. (For further reading see, Lamarck, *Theory of Inheritance of Acquired Characteristics*, 1801) While Lamarckian inheritance principles are not applicable to biological reproduction, they can avail themselves to the social transfer of cultural knowledge, as evolutionary biologist Stephen J. Gould suggests. Thus, we can observe that language has intertwined elements of cognition and culture.

The association between the cognitive and social aspects of language brings us rightly to the debate over linguistic relativity, which contrasts the relationship between biological production of language and the development of social thought. Let's consider how aspects of language are said to be influenced by thought and how modes of thought may be affected by language. Traditional approaches to the study of relativity have long focused on the syntactical and lexical diversity of natural languages. Such views contend the grammars of different languages not only control the discourse of their users, but influence the users' thoughts as well. This belief was summarized in the mid-twentieth century in the "theory of linguistic relativity", also referred to as the Sapir-Whorf hypothesis.

The "linguistic relativity principle"... means, in informal terms, that users of markedly different grammars are pointed by their grammars toward different types of observations and different evaluations of externally similar acts of observation, and hence are not equivalent as observers but must arrive at somewhat different views of the world.

Whorf, 1956, p. 221

Grammar viewed from this prospective not only comprises syntactical structures for producing and governing patterns of language, but also provides a framework for conceptualizing the speakers' view of the world. Evidence of this is often cited by the fact that multilingual speakers are able to experience the world through the lenses of diverse cultural and lexical content, whereas, monolinguals tend to possess a cultural bias toward experience. As such, linguistic relativity provides that the development of different grammars arose in response to the unique needs of particular cultures and environments. However, with the publication of Noam Chomsky's *Three Models for the Description of Languages* (1956), followed by his seminal *Syntactic Structures* (1957) and development in his subsequent works, in what is often referred to as the *Chomskyan Revolution*, this concept of grammar was radically transformed.

Chomsky asserted that the structural nature of all grammars was essentially the same, in that the rules governing all languages are derived from syntactic computations which possess communitive properties. Thus, no matter how differently they are formulated, all grammars are de facto the same. Moreover, this equivalency is what enables any human being the competence of generating any natural language, regardless of one's culture or ethnicity. As a result of this recognition, there was a shift away from the view of distinct grammars with socially significant and diverse practices. In the Chomskyan view, all grammars, though by appearance diverse and discursive, are in fact equivalent finite sets of rules, each capable of producing infinitely diverse combinations of language.

The formalization of rules became the principal component in Chomsky's hierarchy of linguistics. It allowed for the identification and analysis of syntactical structures, in well-defined grammatical sequences, with a mathematical regularity. Chomsky demonstrated that the construction of such grammatical rules was far more complex and difficult to logically formulate than had been previously supposed. Moreover, Chomsky

asserted that many of the idiosyncrasies of the natural languages have neither been formally explained nor even collated, yet they appear to be intuitively understood by their native speakers. Given this insurmountable fact, Chomsky compels us to account for the grammatical competence that every newborn gains of their native language. Let's consider the logic of the problem associated with the following examples:

- 1a I think Mr. Holmes will question Dr. Moriarty.
- 1b I think that Mr. Holmes will question Dr. Moriarty.
- 2a Who do you think will be questioned by Mr. Holmes?
- 2b \*Who do you think that will be questioned by Mr. Holmes?

With no official instruction, and with limited positive and negative evidence, children seem intuitively capable of producing such grammatical sentences while avoiding the ungrammatical ones. With finite exposure and provocation, they end up being able to produce and process an infinite number of grammatically acceptable sentences. Appreciation of this dilemma, Chomsky framed as the *Poverty of Stimulus Argument*, is one of the most famous, if not controversial proposals in all of linguistic debate. This argument obliges the linguist to ask, what provides the native English learner with the positive evidence for the acceptable transformation of 1a to 1b, while providing the negative evidence necessary to avoid the ungrammatical transformation from 2a to 2b. Moreover, the underlying principles behind such grammatical logic may at times go undetected from even the most scrupulous study of professional linguists and logicians. Yet, every normal child is capable of learning and logically using his or her native language, without any specialized instruction or explicit input. For his part, Chomsky hypothesizes that the syntactic rules of such structures are perhaps not immediately understood on the surface of a given utterance, but rather inferred from deeper structures. He would eventually term these deep structures *Universal Grammar*. (Chomsky, 1981) That is, a language faculty deeply fixed in all human languages, but not explicitly visible or accessible in the grammar of any one language.

In Chomsky's account, this language faculty comprises what he terms *I-language* (internal language) and *E-language* (external language). I-language is a biological linguistic configuration innate to the structure of every human brain. As such, it is responsible for the emergence of the E-language or collective language of a community at large. In other words, an E-language is an I-language made observable; it constitutes the natural languages, developed by specific language communities, such as English, Spanish, Arabic, etc. While there are as many as 8,000 natural languages worldwide, each with distinct lexical and grammatical items, Chomsky argues that the underlying principles of I-language can be derived from the survey of a single E-language. "The inference is legitimate, on the assumption that humans are not specifically adapted to learn one rather than another human language." (Chomsky, 1980, p.48) Because I-language, unlike E-language, is reliant on only the substructures of Universal Grammar, it has no external reference and is not susceptible to social influences. One particular such substructure that Chomsky has identified, as an inherent principle of all human languages, is *recursion*.

In linguistics, the essential function of recursion is the ability to embed one phrase within another phrase recursively to create larger phrases. For his purposes, Chomsky has labeled this operation unbounded *Merge*, because such merging recursions appear in human language seemingly without restriction. For example, "I believe, you know, I thought, you said, you never want to see me again." would produce a recursive structure resembling: {I, {believe, {you, {know, {I, {thought, {you, {said, {you never want to see me again}}}}}}}}}. So central is recursion to Chomsky's notion of Universal Grammar, he has suggested the development of unbounded Merge is in fact the origin of human language.

Within some small group from which we are descended, a rewiring of the brain took place in some individual, call him Prometheus, yielding the operation of unbounded Merge, applying to concepts with intricate (and little understood) properties ... Prometheus's language provides

him with an infinite array of structured expressions.

Chomsky, 2010, p.59

We must then regard Chomsky's Prometheus, favored with the miraculous blessing of a language faculty, as the common ancestor of all modern humans. This dramatic macro-mutation, among all others, culled the human race from the remaining dull creatures of this world and propelled us to prominence. According to this view, language is the result of a sudden enigmatic emergence of the first-ever human I-language, the occurrence of which happened in the brain of a single individual, followed much later by the gradual development of communal E-languages. Moreover, the acquisition of every subsequent human language is the product of certain language-specific principles and parameters operating between the syntaxes of I-languages and E-languages. That is, there are universal principles that enable the grammars of all I-languages, and there are specific parameters that restrict the grammars of each E-language. Both, the principles designated to I-languages and the parameters associated with E-languages, are taken collectively to reflect fixed biological features that are unique to the development of the human brain. However, in the maturity of a normal child there is divergence. This occurs between the principles which operate internally, without any regard for external environmental factors, and parameters which evaluate external linguistic input.

Universal Grammar, operating within a set of I-language absolutes, across the entire spectrum of human languages, attempts to denote principles which do not vary from one E-language to the next. According to this hypothesis, there are also parameters that are not fully determined by Universal Grammar, which can vary cross-linguistically in the diversity of E-languages. They are constrained by the range of choices made available by Universal Grammar, and from these principles and parameters human language emerges and operates.

## Discussion

## 1. Continuity

To trace the origin of language is to trace the origin of the human species. At present, humans alone, among all the species of animals that exist on this planet, hold sway over the dominion of language. Stretching back in time a few million years, we can follow a paleontological map of artifacts that led us to this point, from Australopithecus through the genus *Homo habilis*, *erectus*, up to modern *sapiens*. A trail of evidence left in the wake of our primordial ancestors reveals some very important distinctions between hominids and all competing families of animals. Humans, more than any other species, have undergone a continuous progression in the increase of our brain sizes and cognitive capacities. From our ancestral fossil record beginning 2 - 3 million years ago, we can observe that the cranial capacity of *Australopithecus* was approximately 500cc, *Homo habilis* 600cc, *erectus* 850-1100cc, and *sapiens* 950-1800cc. This long steady progression in cranial sizes has resulted in modern human brains that range in volume from approximately 900-1600cc. In comparison, chimpanzees, our closest living primate relatives, have brains that are about one-third the size of our own, though we share roughly the same body size. Most of the differential in brain-size reflects an evolutionary expansion of our cerebral cortex, a network of regions that support such sophisticated cognitive domains as language, theory of the mind, reciprocal exchange and problem solving. (Rilling & Stout, 2014)

Differences in relative brain sizes may go a long way in explaining the cognitive differences that modern humans have with our fellow primates and non-primate anthropoids, as well as our distant ancestral hominids. However, perhaps we should take pause in assuming that size is all that matters. Scientific inquiry plainly delineates the human brain is physically more similar to the brains of our fellow primates than that of other mammals. However, it is not as obvious whether the human brain evolved merely as a larger version of a preexisting primate design or as a qualitatively different sort of organ altogether. Furthermore, all nonhuman primate brains do not appear to be scaled versions of a

replicated template, but rather fundamentally different from each other in composition. (Rilling, 2006) In fact, there are stark inter-species differences among all nonhuman primates.

Analysis reveals that sometime after the divergence of the common ancestry among gorillas, chimpanzees, bonobos, and humans, there was an unusual change in size of differences between the cerebral cortex and cerebellum in each of these lineages. Either the cerebellum of the gorilla lineage increased more rapidly in comparison to the size of its cerebral cortex, or the ancestral lines of chimps, bonobos, and humans experienced a more rapid increase in the volume of their cerebral cortex, in comparison to the size of their cerebellums. Moreover, the human cerebellum is clearly larger than that of any other primate, even after adjusting for differences in body weight. Drawing further distinction between primates, Matano (2001) revealed, that the evolutionary development of the dentate nucleus in humans was far more progressive than in that of great apes. By comparison, the composition of the ventral half (v) of the nucleus in ratio to the dorsal half (d) (v/d) was found to be 2.11 to 1 in humans while it was 1.64 to 1 in great apes.

What this suggests is that even though humans have comparatively large cerebella, they either have a small cerebellum for the size of their cerebral cortex or a large cortex in respect of their cerebellum. Evidence, at least when measured against our fellow primates, seems to support the latter. The prominence of the ventrolateral portion of the dentate nucleus over the dorsolateral portion insures the former, with its fiber connections to the frontal area of the cerebellar cortex, has far greater mediation over the performance higher cerebellar functions. As such, continuity of development has afforded humans highly functioning cognitive and language abilities. If we cannot precisely determine when such a distinction occurred, perhaps it would be better to ask what events led up to the appearance of these capacities. The answer may be found in several coinciding and rather unsuspecting biological changes in

our evolutionary past.

The lowering and widening of the shoulders, an expansion of the waist, and development of a twisted humerus in the upper arm, all provided Early Upper Paleolithic humans with the ability to throw objects extremely fast and accurately. Among all living species, only humans and chimpanzees possess the ability to throw objects overhanded, though the speed, accuracy and frequency at which chimpanzees throw is significantly less than that of humans. Moreover, chimpanzees do not seem to have ever developed a purpose to put this skill to use. For early humans, however, this unique ability undoubtedly had profound repercussions, not the least of which was the development of efficacious hunting skills. By applying this exceptional evolutionary trait, early humans gained a competitive advantage that rapidly propelled them to the top of the food chain. While the evolutionary success of the *Homo sapiens* cannot be traced back to any particular biological feature, the ability to hunt and consume large game was, in point of fact, antecedent to the sapiens development of larger bodies and brain sizes. (Holt, 2008; Rhodes & Churchill, 2009; Roach et al., 2013)

Subsequent increases in body and brain sizes clearly would have resulted in an increase of motor coordination. Undoubtedly, one effect that ensued from this development was a further augmentation of hunting skills, keeping in accord with the evolutionary imperative to increase food supply, and thus allow for perpetuation of favorable traits to succeeding generations. However, more importantly for our discussion, evidence of constant and continuous increases in brain size would have coincidentally allowed for gradual continuous increases of cerebral cognition. A number of recent studies have revealed that cognitive functions and motor skills developed simultaneously from common origins, evidence of which can be found in the fact that today they both operate in shared regions of the brain.

[There is] converging physiological evidence that the



subdivisions of human BA6 have a critical role in cognitive processing in a modality-specific manner: medial and lateral BA6 are preferentially involved in the cognitive update of verbal and spatial representations, respectively. This suggests that the function of at least a part of this motor area is not restricted to motor control but relevant to nonmotor cognition. This is similar to the idea that subdivisions of the basal ganglia and cerebellum, previously regarded as pure motor areas, have cognitive functions.

Tanaka, Honda & Sadato 2005, p. 499-500

Cohabitation is indicative of coevolution; both skills operate together because they originated together in continuous development. There is also a logical argument to be made for the benefits associated with the protracted continuity of classical evolutionary development. As Pinker and Bloom (1990) succinctly frame this notion: [There exist] “an obvious advantage to being able to acquire information second-hand: by tapping into the vast reservoir of knowledge accumulated by other individuals, one can avoid having to duplicate the possibly time-consuming and dangerous trial-and-error process that won that knowledge (p. 712).”

## 2. Discontinuity

Darwin, in his attempts to offer natural explanations for species' development, went to great lengths to show continuity between humans and animals. It was his considered view that “the difference in mind between man and the higher animals, great as it is, is certainly one of degree and not of kind.” (Darwin, 1871, p. 105) Yet, nothing obliges us to accept the hypothesis that language was derived from animal communication, or even the notion that it evolved out of small continuous changes and adaptations over lengthy periods. If we view language as a system capable of infinite generation (that is language as an infinite use of finite means), and we assume that logic dictates that we cannot go from finite to infinite in small steps, we must therefore conclude discontinuity exists between the origin of language and classical natural selection. In other words, the capacity for infinite production either exists or it does not; there

are no aggregate steps that lead to infinity. From this perspective it seems more likely that such an event would have had a sudden dramatic emergence, rather than having strictly evolved over prolonged periods of continuous development.

Discontinuity theories maintain that language is unique to humans and that nonhuman animals share only the most basic communicative abilities with humans. (Hauser et al. 2002; Jackendoff and Pinker 2005; Nystrom and Ashmore 2008) Moreover, discontinuity theorists cite lack of evidence for an evolutionary antecedent to human language, which by all appearances is far too complex to have emerged from mere animal forms of communication. Numerous scholars, including Chomsky (1982, 1988, 1991), Gould (1991), Piattelli-Palmarini (1989, 1990) and Jenkins (2000), have suggested that the language faculty did not itself initially emerge as an evolutionary adaptation but rather as a by-product of an earlier adaptation. Chomsky (1982) speculates that “it could, for example, be a consequence of the increase in brain size and complexity (p.22).” That is, as a result of natural selection, “the brain gets so complex, it simply has to encompass systems of discrete infinity (p. 23).” In other words, the human brain may have reached a biological tipping-point, in size and complexity, in which development allowed for the emergence of a computational mechanism able to generate an infinite capacity. Furthermore, Chomsky theorizes that human language, facilitated by such a mechanism, is governed by genetics that were likely the result of a recent mutation, which is unique to humans. Rather than emerging from an adaptation of natural selection, having continuity with animal communication, it must have required the sudden occurrence of a macro-mutation, possibly in a single member or small group of our species.

“Punctuated equilibrium is a model for discontinuous tempos of change at one biological level only: the process of speciation and the deployment of species in geological time.” (Gould & Eldridge, 1977, p.45) The random changes that occur in instances punctuated equilibrium

are mutations in traits that are transferable in sequences of DNA. The modules of genetic traits inherited from previous generations can be successfully replicated and passed to succeeding generations. If Chomsky's is correct, his Prometheus was the beneficiary of such a mutation. Though most mutations that occur within a species can be deleterious, the mutations that result from punctuated equilibrium can be very distinct and beneficial to the survival of the individual or group on whom they are bestowed. Through propagation of their genes, by means of a heightened reproductive capacity, carriers of such mutations may eventually overtake and alter the traits of their entire species.

### 3. Origins

We may surmise that thoughts can occur independently without any requirement of language. A brain, whether human or nonhuman, may involuntarily be subjected to symbolic or abstract imagery. However, the use of language will be required if one intends to escape the vagueness of mere ancillary mental formations. If we desire to engage in sustained contemplation, if we wish to exercise reflection on past events, or more importantly, if we want to make our thoughts manifestly understood by our fellow creatures, we will need to catalyze our thoughts in a collective language. Such an act would seem to require the recapitulation of prior thoughts, into current thoughts, to produce yet larger ongoing thoughts. As Chomsky has rightly pointed out, such an act requires the employment of recursion. Let's also make a distinction between dependency of thought on recursion and the dependency of language on recursion. Language is wholly dependent on contemplative thought, contemplative thought is wholly dependent on recursion, but it does not follow that recursion must exist in language. That is to say, even if recursions are a cognitive prerequisite to produce language, it doesn't necessitate that recursion must be expressed in the production of language. We may assume that it is possible to have natural languages that are noticeably void of verbal recursions, even though the thoughts from which such languages are derived require cognitive

recursions. As Jackendoff (2002) suggests, "Our language faculty provides us with a toolkit for building languages, but not all languages use all the tools" (p.204).

Many languages seem designed to minimize recursive embedding. Let's observe the English sentence: "*They stood watching us fight.*" {They, {stood, {watching, {us, {fight}}}}}. In English this sentence can be recursively accomplished by subordinating the two actions {they, {stood, {watching, {us}}}} to the topic "we were fighting. However, in Bininiji Gunwok, an aboriginal language isolated to northern Australia, such an expression would proscribe any practice of subordination and thus entail: "*They stood, they were watching us, we were fighting each other.*" (Evans, 2003, p. 633) While both the English and the Bininiji Gunwok sentences express the internal structure of a recursive reflection, upon a past event, only the English sentence recapitulates the mental recursion externally in its verbal speech.

The Amazonian language Piraha would seem to preclude recursion altogether. Piraha not only lacks any subordination it has no use for even embedding in possessive clauses (Everett, 2005). Only one possessor is permitted for each noun phrase, therefore sentence 3a (with the double possessive "*Ko'oi's son's*") is ungrammatical.

3a. \**ko'oi hoagi kai gaihii 'iga*  
 (name) son daughter that true  
 "That is Ko'oi's son's daughter."  
 (1)

3b. *isaabi kai gaihii 'iga*  
 (name) daughter that true  
*ko'oi hoagi kai 'aisigi -ai*  
 (name) son daughter the same -be  
 "This is Isaabi's daughter. Ko'oi's son being the same."  
 (2)

Only by removing one of the possessives from 3a or parsing them into two separate sentences (as in 3b) can a syntactic misnomer be avoided. Cultural implications,



stemming from the isolation and limited size to the Piraha community, seem to offer some explanation for this particular restriction on possessives. Linguistic anthropologist Daniel Everett suggests, "Every Piraha knows every other Piraha, and they add the knowledge of newborns very quickly. Therefore, one level of possessor is all that is ever needed." (Everett, 2005, p. 630)

It is also abundantly clear that while recursive thinking is a prerequisite for recursive embedding in syntax, the existence of recursion in communication does not necessitate that it is derived from profound reflective thoughts. Numerous animals exhibit various forms of recursion in their communicative systems. For example, honey bees use intricate recursive dance performances to communicate the location of food sources to second and third parties. Yet, the boundary between humans and other species is entirely obvious. Human language alone embodies meaning into thousands of arbitrary symbolic components, constituent parts that commonly take the form of words. Moreover, human language alone utilizes complex syntax to organize and regulate its communicative system. Language is the only communicative system whose origin and function seems irrevocably tied to recursive thoughts, which bind learned symbols to a governing syntax. As we have evidenced, it is possible for languages to exist without incorporating recursion into their syntax. In fact the earliest human languages, or protolanguages, undoubtedly did not employ recursive syntaxes. If viewed on a continuum, from the origin of recursive thought, the first appearance of recursive syntax, in all likelihood, would not have ensued until the passage of countless generations. The speed and length of such a transition is the key to understanding when the origin of true human language transpired.

## Conclusion

What seems most certain is that language is the product of a combination of biological factors that enable a cognitive capacity to engage and interact in social activities. Language also provides the ability to transfer

social traits, by means of recursive inheritance from one generation to the next. In other words, {language is, {a transferable social trait, {enabled by, {a cognitive capacity, {produced from, {a biological function}}}}}}.

What seems less certain is the source of its origin. Though it is the considered view of evolutionary biology that language emerged from natural selection out of certain random genetic mutations from particular selective pressures over many generations of human development, it is by no means a forgone conclusion. Nor is it clear that language continued to develop in humans solely because it provided a competitive advantage to communicate intentions in hunting-gathering groups, warn against impending dangers or propagate reproduction. It is altogether possible that language was not even an adaptation of evolution, but merely a by-product of a fortuitous coincidence, which accompanied the sudden appearance of heightened perceptual thought. As Gould and Eldridge (1977) rightly point out, the tempo of biological change in geological time can be discontinuous. There is no evidence that this momentous event was achieved through protracted natural selection, though that is most certainly plausible. However, as evolutionary biologist Richard Lewontin (1998) reproaches, we should not assume that everything in nature is knowable. Understanding the origin and development of anything requires more than theories; it requires artifacts and evidence. "Form and even behavior may leave fossil remains, but forces like natural selection do not. It might be interesting to know how cognition (whatever that is) arose and spread and changed, but we cannot know. Tough luck." (p.130)

## Notes

(1) & (2), Everett, 2005, p. 630, (numbers changed to conform with my numbering)

## References

- Chomsky, N., 1980. On cognitive structures and their development: A reply to Paget. In: *Language and learning: The debate between Jean Paget and Noam Chomsky*. ed. M.Piattelli-Palmerini, p. 35-52. Harvard University Press.
- Chomsky, N., 1981. Lectures on Government and Binding.

- Berlin: Mouton.
- Chomsky, N., 1982. *The Generative Enterprise. A Discussion with Riny Huybregts and Henk van Riemsdijk.* Foris Publications, Dordrecht.
- Chomsky, N., 1991. Linguistics' and cognitive science: problems and mysteries. In: *The Chomskyan Turn*, (Ed.) A. Kasher. Basil Blackwell, Oxford, pp. 26-53.
- Chomsky, N., 2010. Some simple evo devo theses: how true might they be for language? In *The Evolution of Human Language*, eds Larson R. K., Déprez V., Yamakido H., editors. (Cambridge: Cambridge University Press; ), 45-62.
- Darwin, C. R., 1871. *The descent of man, and selection in relation to sex.*
- Evans, N., 2003. *Bininj Gun-wok: A Pan-dialectal Grammar of Mayali, Kunwinjku and Kune.* (2 volumes), Pacific Linguistics, Canberra.
- Everett, D.L., 2005. Cultural constraints on grammar and cognition in Piraha. *Current Anthropology* 46. 621-46
- Gould, S.J., Eldridge, N., 1977. Punctuated equilibria: the tempo and mode of evolution reconsidered. *Paleobiology*, 3(2): 115-151.
- Gould, S.J., 1991. Exaptation: a crucial tool for evolutionary psychology. *Journal of Social Stellenbosch Issues Papers* 47, 43-65. in *Linguistics*, Vol. 33, 2000, 21-48 doi: 10. 5774/33-0-48 47.
- Gould, S.J., 1996. *Full house: The spread of excellence from Plato to Darwin*, New York.
- Hauser, M., Chomsky, N., & Fitch, W. T. (2002). The language faculty: What is it, who has it, and how did it evolve? *Science*, 298, 1569-1579.
- Holt, B.M., Formicola, V., 2008. Hunters of the Ice Age: The biology of Upper Paleolithic people. *American journal of physical anthropology. Suppl* 47, 70-99.
- Jackendoff, R., 2002. *Foundations of language: Brain, meaning, grammar, evolution.* Oxford University Press.
- Jackendoff, Ray & Steven Pinker 2005. "The Nature of the Language Faculty and its Implications for Evolution of Language (Reply to Fitch, Hauser, and Chomsky)." In: *Cognition* 97, 211-225.
- Jenkins, L., 2000. *Biolinguistics. Exploring the Biology of Language.* Cambridge University Press, Cambridge.
- Leiner, H.C., Leiner, A.L., Dow, R.S., 1993. Cognitive and language functions of the human cerebellum. *Trends Neurosci* 16: 444-447.
- Lewontin, R. C. 1998. The evolution of cognition: Questions we will never answer. In: *An invitation to cognitive science* (Scarborough, D. & Sternberg, S., eds.), vol. 4: Methods, models, and conceptual issues. Cambridge, MA: MIT Press.
- Matano, S. 2001. Brief communication: proportions of the ventral half of the cerebellar dentate nucleus in humans and great apes. *Am J Phys Anthropol* 114: 163-165.
- Nystrom, P & Ashmore, P., 2008. *The Life of Primates.* Upper Saddle River, New Jersey: Prentice Hall.
- Piattelli-Palmarini, M., 1989. Evolution, selection and cognition: From "learning" to parameter setting in biology and the study of language. *Cognition* 31, 1-44.
- Pinker, S., P. Bloom. 1990. Natural language and natural selection. *Behavioral and Brain Sciences* 13: 707-784. Power, C. 1998.
- Rhodes, J.A., Churchill, S.E., 2009. Throwing in the Middle and Upper Paleolithic: inferences from an analysis of humeral retroversion. *Journal of Human Evolution*. 56, 1-10.
- Rilling, J.K., Stout, D., 2014. Evolution of the neural bases of higher cognitive function in humans. *The Cognitive Neurosciences V.* Cambridge,
- Roach, N.T., Venkadesan, M., Rainbow, M.J., Lieberman, D.E., 2013. Elastic energy storage in the shoulder and the evolution of high-speed throwing in Homo. *Nature*. 498, 483-6.
- Tanaka S., Honda M., Sadato N. 2005. Modality-specific cognitive function of medial and lateral human Brodmann area 6. *Journal of Neuroscience*. 25, 496-501.
- Whorf, B.L., 1956. *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf.* (ed. Carroll, J.B.). Cambridge, MA: MIT Press.